FEDERATED MALAY STATES.

IMPERIAL BUREAU
30 JULY 1930
OF MYCOLOGY

ANNUAL REPORT

ON THE

DEPARTMENT OF AGRICULTURE,

S.S. AND F.M.S.,

FOR THE YEAR

1929

BY

H. A. TEMPANY, D.SC., F.I.C., F.C.S.,
Director of Agriculture, S.S. & F.M.S.

KUALA LUMPUR:
PRINTED AT THE FEDERATED MALAY STATES GOVERNMENT PRESS.

26-5-1930. 1930.

CONTENTS.

	Pages.
INTRODUCTION	1
Part I.	
AGRICULTURE IN MALAYA	1– 8
Weather Conditions in 1929	1
Crop Conditions	1– 7
Fruit	7– 8
Part II.	
THE WORK OF THE DEPARTMENT OF AGRICULTURE	9
INTRODUCTION	9–11
SUMMARIES OF REPORTS OF HEADS OF DIVISIONS	11–17
Field Division...	11–13
Mycological Division	13
Chemical Division	13–14
Entomological Division	14
Division of Soils and Plant Physiology	15
Division of Economic Botany	15–16
Instruction Division...	16
Division of Economics	16–17
AGRICULTURAL DIVISION	17–18
Experimental Plantation, Kuala Lumpur	17
„ „ Serdang	17
Experimental Work	17–18
Experimental Plantation, Cameron's Highlands	18
GENERAL	18

APPENDIX.

A. ORGANISATION OF THE DEPARTMENT OF AGRICULTURE, S.S. AND F.M.S.	19

FEDERATED MALAY STATES.

ANNUAL REPORT OF THE DIRECTOR OF AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES, FOR THE YEAR 1929.

INTRODUCTION.

In previous reports it has been usual to review the agricultural conditions in Malaya and the work of the Department of Agriculture under one heading.

In the present instance this procedure has been slightly departed from, and this report consists of a general review of agricultural conditions followed by a summarised account of the main activities of the different branches of the department.

PART I.

AGRICULTURE IN MALAYA.

WEATHER CONDITIONS IN 1929.

In most parts of the Peninsula the year was characterised by three well-marked periods of unusually dry weather.

The rain that generally accompanies the north-east monsoon was very deficient in January and in most parts of the country the dry period expected during February and March followed normally, so that an extended dry period was experienced during the first two or three months of the year. In the south of Perak, however, the rainfall was normal, while on the east coast of Pahang, February and March were very wet months. This dry period was most marked in the north of Perak and in Singapore Island and Southern Johore.

The usual showery weather commenced in March in Western Pahang and in April elsewhere and continued in most localities into June. The rainfall during this period was well above the average in parts of Perak, in Selangor and in Malacca. On the east coast of Pahang, however, a dry period commenced in April and, with the exception of showery weather in June, continued until September.

In Perak during June, and elsewhere early in July, the second dry period commenced and lasted until September. In the latter month heavy rains were experienced which continued fairly normally until the end of November, although in Perak, Malacca and the southern end of the Peninsula, the rainfall in October was deficient.

In December the north-east monsoon rains failed almost entirely and the third and most accentuated period of dry weather was experienced throughout the entire Peninsula, though the drought was less marked in Malacca.

It will be seen from the above summary that in general the rainfall was definitely deficient. This deficiency was most marked in the northern, eastern and southern areas, and in places amounted to as much as 25 per cent. of the normal rainfall. In the central western States the total rainfall approached more nearly to the average, though its distribution throughout the year was not as even as is that of a normal year.

CROP CONDITIONS.

RUBBER.—The total planted area under this crop in the Straits Settlements and Federated Malay States at the end of the year was estimated at 1,800,300 acres, an increase of about 30,000 acres. The net exports from the Federated Malay States during the period was 261,353 tons, an increase of 86,866 tons. It is not possible to furnish export figures for the Straits Settlements for 1929, though it is hoped to have these available for 1930.

The average price of smoked sheet during the first quarter was 38 cents per pound, after which time the price gradually declined to 35 cents in August, 34 in September, 31 in October and 25 cents in November. There were signs of a slight rally in December but prices declined again towards the end of the year. At the end of the year kampong unsmoked sheet was being sold at $27 a picul which is equivalent to slightly over 20 cents a pound.

Pest and Diseases.—No new disease of importance has been reported. Investigations are being continued on the treatment of root diseases and diseases of the tapping panel, especially in regard to the application of fungicides and the comparative value of different fungicides.

A bio-chemical investigation of Brown Bast has thrown further light on the cause of this disease and confirmed the work of previous investigations as to its physiological character.

The problem of the most satisfactory treatment of Mouldy Rot on small holdings in order to avoid the cessation of tapping of affected trees is receiving attention.

Attention is drawn to the increase in the incidence of Mildew Leaf Disease caused by *Oidium Hevea*. Areas in several districts during the year were reported as being affected with secondary or abnormal leaf fall, which was diagnosed as Oidium. Recently a very severe outbreak has occurred in several districts, during refoliation immediately after wintering. This was undoubtedly caused by the very dry weather after wintering had finished.

Several types of liquid and dry or dust sprayers are being introduced for experimental work on this disease.

Budgrafting.—The chief feature of interest in connection with the plantation rubber industry during 1929 is the continuing interest which is being taken in vegetative reproduction by means of budding.

This is shown by the large number of enquiries received by the Rubber Research Institute for advice and assistance in connection with the most suitable clones for planting and for instruction in technique, and also in the large amount of budwood and budded stumps imported from the Netherlands East Indies in addition to the use of material from Prang Besar Estate in Malaya.

A large proportion of European estates have now a certain percentage of their younger areas under selected budded rubber. In a few cases Chinese have planted budded material and, in one instance, an area of rubber owned by a Malay was budded by an officer of the Rubber Research Institute as a demonstration to the owner and other surrounding small holders.

Replanting.—In view of the possibilities of high yielding material, considerable interest is being taken in replanting problems, on estates on which the past tapping systems, loss of soil and root diseases are responsible for decreasing yields of latex. The most difficult problem is that of the reconditioning of soils for replanting.

In the case of areas affected by root disease or on which the trees have been badly or excessively tapped in the past, but where the soil has not deteriorated due to erosion or other factors, replanting is an economic proposition and is being carried out on a number of estates.

Rubber Preparation.—Interest is being taken in the problem of the substitution of an air-dried sheet for smoked sheet and experimental work is being carried out. The problems of factory economics, especially in regard to the depth of coagulating tanks, and width of sheeting machines, is receiving considerable attention, and has evoked much interest among planters. The export of preserved (ammoniated) latex has decreased considerably owing to the fact that the large American company exporting this product has now closed all contracts on estates. Considerable interest, however, is still being taken in this product, especially by one agency firm from whose estates regular supplies are exported.

The export of concentrated latex (Revertex) is increasing and another plant has been erected on an estate in Johore.

Conferences.—A valuable Rubber Conference was organised in Java by the Dutch rubber workers under the presidency of Prof. Dr. O' de Vries, Director of the Proefstation voor Rubber at Buitenzorg, Java.

This was attended by delegates from the Rubber Research Institute.

Experiment Station.—Good progress has been made both in planting and building programmes at the Experiment Station of the Rubber Research Institute.

As usual under similar circumstances, the low price of the commodity is reflected to some extent in the poorer condition of upkeep of many small holdings, though this is much more applicable to Malay-owned holdings than to land owned by other nationalities. These remarks apply similarly to the question of over-tapping, which is fairly general at present on Malay-owned holdings, but less general on land owned by other Asiatics.

PADI, 1928-1929 SEASON.—The approximate area planted in padi during 1928-1929 season was 651,740 acres of wet padi and 36,124 acres of dry padi distributed as follows (the corresponding yields being also shown):

State.	Wet.		Dry.	
	Acreage.	Yield, gantangs.	Acreage.	Yield, gantangs.
Federated Malay States ...	156,327¾ ...	28,769,066 ...	18,899½ ...	2,827,130
Straits Settlements	75,138 ...	23,307,377 ...	936 ...	84,240
Unfederated Malay States ...	420,275 ...	69,120,146 ...	16,288 ...	2,121,351
Total ...	651,740¾ ...	121,196,589 ...	36,123½ ...	5,032,721

In Krian, planting was very late owing to the late commencement of the rainy season and weather conditions were adverse almost throughout the season, there being unusually long periods of dry weather. There was a very heavy attack of stem borer, and the leaf hopper, *Sogata pallescens*, did considerable damage. The result was a late and poor harvest, the average yield being 161 gantangs per acre as compared with 229 gantangs for the previous year. The crop was light also in Larut and Kuala Kangsar districts of Perak, but better in Upper Perak, although not quite up to the average shewn there.

In South Perak the crop was very fair, being an increase both in acreage and average yield over the previous year.

Over the major portion of Province Wellesley yields were average, but in the Sungei Acheh area adjoining Krian where conditions approximate to those of this district, except that in Sungei Acheh there is no system of irrigation, yields were worse than those in Krian, much of the padi being too poor to reap. In Selangor, Negri Sembilan and Malacca a fair crop was produced. In Pahang the planted area was less than the previous year by 6,000 acres and very poor crops were harvested, excepting in the district of Raub and in some of the road mukims of Lipis district where a good crop was harvested. As in Krian, the crop in Pahang suffered from late planting and spells of dry weather during the growing period, whilst, in addition, floods in December destroyed such padi as was not harvested by then.

To sum up, the 1928-1929 season must be considered a poor one owing to the very poor crop harvested in Krian, the most important padi area in the Straits Settlements and Federated Malay States, although average, and in some instances, good yields were obtained over a large part of Province Wellesley, in Selangor, Negri Sembilan and Malacca.

1929-1930 SEASON.—Again planting was unusually late in Krian district of Perak, so prospects cannot be considered very promising as, although over a large part of the area the padi at the end of the year appears to be growing well, past experience indicates that late planting is generally followed by a poor return of garnered grain, for even if growth be good and a fair standing crop is indicated, rains generally interfere with the harvest and cause considerable loss in the case of a late reaped crop. Prospects are more promising in Kuala Kangsar and the Upper Perak districts of Perak, and at the end of the year very fair crops were being reaped in the earlier planted areas of Kuala Kangsar. In Perak South the planted area shows a large increase over the previous year and a fair yield is anticipated.

In Province Wellesley prospects are not good. A good crop is expected in Negri Sembilan, Malacca and the inland districts of Selangor, whilst in Pahang West the crop is expected to be very much better than last season and the area planted is greater. In Pahang East, however, a poor crop was reaped at the end of the year.

Campaigns for the destruction of rats in padi fields were maintained in the Krian and Province Wellesley areas, while a similar campaign was inaugurated in Malacca during the year. The operations were carried out under the control of the Department of Agriculture, the methods employed comprising trapping and poisoning combined with a system of payment for the tails of captured animals.

The campaign continued to give satisfactory results in the reduction of damage by these rodents in padi fields.

Considerable damage was recorded by padi stem borers, in the Krian area and also in Province Wellesley during the year. The investigation of the padi stem borers by the Entomological Division was taken in hand and observations begun with a view to ascertain whether a means of systematic liberation of parasites was possible. The Entomological Division organised the breeding of large numbers of parasites of stem borers, a *Trichogramma* sp., and by the end of the year these parasites may, it is hoped, be liberated in the Krian area at the rate of 40,000 per day. It is as yet too early to say whether these measures will have any practicable effect, but the work is being continued.

Coconuts.—No exact figures are available for the area under coconuts in Malaya. It is anticipated that the census now in progress will yield reliable figures which can be used as a datum line for computation in subsequent years.

Exports of copra and coconuts for the past five years with corresponding values are shewn in the accompanying tables:

Net Export of Copra from British Malaya.

Year.	Quantity.	Value.
	Tons.	$
1925	96,554	19,093,938
1926	104,653	21,852,330
1927	86,649	16,562,493
1928	95,091	18,747,129
1929	112,698	19,698,825

Malayan Trade in Fresh Coconuts.

Year.	Quantity.	Value.
	Tons.	$
1925	13,150	462,193
1926	10,002	399,506
1927	15,924	653,188
1928	13,443	532,237
1929	11,175	474,413

Malayan Trade in Coconut Oil.

Year.	Quantity.	Value.
	Tons.	$
1925	7,615	2,807,040
1926	8,449	3,090,973
1927	10,220	3,448,057
1928	9,836	3,171,268
1929	8,675	2,486,106

Net Exports from Malaya of Coconut Products.

Year.	Quantity.	Value.
	Tons.	$
1925	117,319	22,363,171
1926	123,104	25,342,809
1927	112,793	20,663,738
1928	118,370	22,450,634
1929	132,548	22,659,344

A further decline has to be reported in the price of copra. For "Fair Merchantable" quality, the Singapore market opened at $10 per picul (133⅓ lbs.), being nearly $2 less than at the beginning of 1928. The price fell to just over $8 per picul by the middle of the year, thereafter shewing a slight upward tendency until by the end of the year prices ranged fairly steady round $9 per picul, the price for sundried being 46 cents per picul higher. Prices for coconuts themselves in the coastal districts range from two to five cents per nut.

In addition to the fairly well-defined areas of unmixed cultivations of coconuts situated in Province Wellesley, the Krian and Lower Perak districts of Perak, the Kuala Selangor district, the Banting area of Selangor and the large area of small holdings in Johore, very large numbers of coconut palms are to be seen scattered throughout the country. A proportion of these consists of small groups of a few trees planted around dwellings, along canal banks as in Krian and in odd scattered areas, whilst a large percentage is made up of palms in a mixed cultivation, amongst fruit trees or rubber. Palms under these latter conditions can produce but a very small number of nuts, and, in fact, a large percentage of them are unlikely to produce any fruit whatever. Such returns as have been received to date in connection with the Coconut Census indicate that there are very large numbers of these almost or quite worthless palms. Doubtless the retention of a large numebr of coconut palms of no economic value is to some extent due in the Federated Malay States to the Coconut Preservation Enactment, which forbids the destruction of any living coconut palm without permission from a duly authorised official. Apart from a continued extension of the planted area in Johore, largely by Javanese and Bugis settlers, there has been no great extension in the area of unmixed coconuts during the year. Crops everywhere are reported to have been up to the average.

Early in the year the nettle caterpillar, the larvae of *Setora nitens*, appeared in fairly large numbers in Lower Perak, the attack being more prolonged and serious than is usual with this leaf-eating caterpillar in this country. On advice from the Entomological Division systematic hand-picking was carried out successfully on many of the estates concerned.

A series of local outbreaks of *Artona catoxantha* occurred in Krian, East Pahang and Johore.

On one estate the lopping of leaves at too early a stage led to some damage being done by the Red Stripe Weevil, *Ryncophorus schach.*

The question of the quality of Malayan copra has been attracting considerable attention recently. It has for some time been supposed that Malayan copra is inferior in quality to that produced in Ceylon and on the Malabar coast of India, and this view has been upheld by analytical results in the chemical laboratory of the Department of Agriculture which show that the oil content of Malayan copra, on a dry basis, is approximately 66 per cent., while Ceylon and Malabar copra have been found to have an oil content ranging from 69 to 70 per cent. In view of the importance of this question and the necessity for improvement, provision was made for a special fund for the investigation of copra problems. Of this provision a part was contributed by the Empire Marketing Board. Work on these lines was inaugurated by the appointment of an Agricultural Chemist for Copra Research in September, 1929.

There is undoubtedly scope for increased activities in relation to the research on coconut questions and it is to be hoped that the present extensive activities of the Department of Agriculture in this direction may be further co-ordinated and extended in the future. A further point in which investigation is urgently required is that of manuring coconuts. At present coconuts in Malaya are not systematically manured. Experiments with a view to trials to ascertain manurial requirements of coconuts under Malayan conditions are badly needed. Some steps have already been taken to supply this requirement but greater extension is indicated.

In Malaya it is generally accepted that the best soils for coconuts are moderately heavy loam, while they are also extensively grown on peat soils, particularly in Johore and on the East Coast. In other parts of the world typical coconut soils are ordinarily regarded as of the light sandy type. Investigations are required on this point also.

Arrangements were concluded during the year for taking a census in connection with the World's Agricultural Census, 1930. These results when completed will be the first reliable information regarding the area under coconuts in Malaya. Present returns indicate that the acreage under this crop is much larger than has been estimated in the past and in view of the large area not yet in bearing it is probable that exports of copra from Malaya will steadily increase for some years to come. In addition to this, the improvements already effected on most large estates, coupled with the increasing attention given to the scientific aspects of the cultivation of this crop, will result in an increase in crop per acre from the larger estates, together with a reduction in the costs of production. The problem of the thousands of small holdings, approximately five acres each—and there are over 16,000 such in the State of Selangor alone—remains a difficult one. There seems to be little doubt that the produce from these holdings is not marketed to the best advantage of the small holders and in many cases Malays, at any rate, do not harvest their crop satisfactorily. There is little doubt that the small holdings in the well-defined coconut districts in Selangor and also Johore are capable of producing much greater quantities of copra than at present. One of the indications appears to be the organisation of some improved form of marketing the produce. At present this is entirely in the hands of small Chinese merchants. If co-operative organisation could be introduced into the hands of small holders, considerable improvement should result although it is apparent that many difficulties lie in the way of effecting such an improvement.

Coconut crops during the year have been fairly well maintained. The export of copra for the year 1929 amounts to 112,698 tons valued at nearly $20,000,000.

Oil Palms.—The oil palm industry continues to expand. The total planted area is 31,709 acres, the area planted during the year under review being 7,342 acres. One estate has practically 5,000 acres planted, nine estates have between 1,000 and 3,500 acres planted, there are eight estates between 500-1,000 acres each. The total number of estates planted with oil palms in Malaya at the present time is eighteen. It is anticipated that a further considerable extension of the planted area will be effected in 1930.

Eight estates have well-equipped factories for the preparation of palm oil and extraction of the kernels. In every case the centrifuge system has been adopted for the extraction of oil. In addition five factories are in course of erection and will

commence working during the year 1930. The export of palm oil and palm kernels for the year 1929 is 1,831 tons of palm oil and 266 tons palm kernels amounting to $537,811.

Further alienations for this crop continue. In Pahang 13,000 acres have been alienated although the planted area amounts only to 686 acres. In Johore the total area alienated is 58,000 acres, of which 6,457 acres are planted.

It is stated that the products of the oil palm industry continue to be utilised entirely in the tin plating industry of the United States of America. So far as can be ascertained the application of the use of this product in the United Kingdom and other European countries has not yet become general.

The Malayan and Sumatran oils are apparently prefered in the United States on account of the low content of f.f.a. So long as this market remains unsaturated the oils prepared in Malaya and the Dutch East Indies will continue to create a ready demand. When saturation will take place or how it will affect the market is not at present known. In relation to the cultivation of oil palm, rats continue to be the greatest pest of the crop. They attack the newly planted palm and damage the fruits unless efficient control is maintained. The difficulty of controlling this pest on areas where a heavy cover crop is grown has led to the removal of the cover crop on many estates in Johore, since when the damage done by the rats has decreased. Experiments carried out by the Agricultural Division of the Department of Agriculture indicate that the growing of cover crops between young oil palms has a retarding effect on growth and present practice prefers methods of soil retention by physical means rather than by planting cover crops on this account.

A new stem disease of oil palm was recorded on an estate in Selangor during the year and appreciable damage was done. It would appear that this disease is caused by a species of Fomes which is associated with the Brown Root Disease of rubber and other crops. It seems probable that satisfactory measures for the control of the disease can be found. These measures consist of the trimming of the leaf bases from the stems of the palms and treating the surface with a form of disinfectant.

Interest continues to be maintained in the question as to whether or not artificial pollination of the oil palm is desirable. In Malaya artificial fecundation is still extensively practised. In Sumatra it is not. Experience of planters and results obtained by the Agricultural Department, however, indicate that artificial pollination shows little, if any, increased fruit production.

Tea.—The area so far alienated for tea on Cameron's Highlands is 5,780 acres. At the end of the year some of this land was being opened up preparatory to planting. On the area alienated for tea in the Kinta district of Perak 62 acres were planted at the end of the year. Dry weather rendered it difficult to obtain a good stand of plants. Under these conditions the planting of stumps proved the most successful method, other methods tried being seed at stake, basket plants and seedlings from nursery beds.

The total area actually planted with tea in Malaya at the end of 1928 was 573 acres and extensions proposed for 1929 totalled 1,020 acres, so that the total at the end of 1929 can be taken as 1,593 acres. At a special meeting of the Agricultural Advisory Committee, held in December, at which certain planters interested in tea were also present, the whole situation in relation to this crop was reviewed. Experimental work carried out by the Department of Agriculture definitely shows that tea can be satisfactorily grown in the uplands and lowlands of Malaya and that the climate favours the cultivation. Plans have been formulated for the extension of investigations on the crop and a trained agriculturist will be despatched to Ceylon, Southern India and Assam during 1930 for the purpose of studying tea cultivation and preparation as practised in those localities.

Cloves and Nutmegs.—The long established clove and nutmeg industry of Penang still exists, for these spices are still cultivated, mainly by Chinese, on the western slopes of the Penang Hills. Prices ruling during the year were from $75-$90 a pikul for cloves and $70 a pikul for nutmegs. Considerable damage continues to be done to the clove trees by a Cerambycid borer, the complete life history of which has not been worked out.

Gambier.—The cultivation of gambier though still extant in Johore and Negri Sembilan has shown a further decrease.

Coffee.—The area under this crop in Malaya may be conservatively estimated at about 13,000 acres. Considering the large net imports of 3,551 tons of a value of $2,384,817 for 1929, there seems room for considerable local development in coffee planting. There was practically no extension of the planted area in the Straits Settlements and Federated Malay States during the year but in Johore there was a revival of interest in this crop for large estates.

Considerable attention has been devoted to the experimental cultivation of coffee at the Government Experimental Plantation, Serdang, and an area of about 60 acres is now in bearing. The under-mentioned varieties are undergoing trials with a view to ascertaining their cultural characteristics:

(1) Liberian Types.—
(*a*) Abeocuta;
(*b*) Excelsa;
and (*c*) Liberia.

(2) Robusta Types.—
(*a*) Canephora;
(*b*) Robusta;
(*c*) Uganda;
and (*d*) Quillon.

The trials comprise the (*a*) use of green manures, (*b*) leguminous trees as shade and (*c*) the effect of different methods of pruning.

The coffee berry borer, *Cryphalus hampei*, Fen, has to be kept under control on these experimental plots.

Tapioca.—The acreage under tapioca in the Straits Settlements and Federated Malay States is roughly estimated at 4,000 acres. The net exports for Malaya are calculated at 26,175 tons of a value of $3,154,039. The average price for the period 1929 was

Flake	6.32	per picul
Small pearl	7.96	,,

The point of general interest attaching to this crop is the question of cultivation of tapioca with special reference to soil exhaustion. The Chemical and Agricultural Divisions have been collaborating in this work, and a bulletin is now being prepared giving the results of the investigation. The main conclusions may be given here. It has been found that three successive crops of tapioca, grown as a catch crop, remove from the soil

(*a*) as much potash per acre as rubber and coconuts remove in 20 years;

(*b*) as much phosphoric acid as rubber and coconuts remove in 10 years;

(*c*) as much nitrogen as coconuts remove in 12 years and more nitrogen than rubber removes in 25 years.

Such a comparison indicates the extent to which a crop of tapioca draws on the plant nutrients in the soil, but this aspect of soil impoverishment is accentuated when it is remembered that rubber and coconut roots ultimately grow into the deeper layers of soil which are not accessible to the roots of the tapioca plant.

FRUIT.

(*a*) Pineapples.—Notwithstanding the low prices that have ruled for some considerable time for Malayan tinned pines the area under this crop continues to extend. Latest returns give the area in Johore as 42,000 acres and in Singapore as 8,000 acres. Except for some 3,000 acres in Singapore, practically all these pines are grown as a catch crop with rubber. From Johore 1,182,609 cases were exported, an increase of 326,356 cases over the figures for the previous year. The exports for the year totalled 58,692 tons valued at $9,233,732, as compared with 46,400 tons valued at $8,421,230 in 1928. Owing to the low prices ruling the value per ton in 1929 was $157 as compared with $181 in 1928. Factories now number 17, there being 12 in Johore and five in Singapore.

The more newly erected factories are great improvements on the older ones. This is notably the case in regard to a factory in Johore that commenced operations in June, where the machinery and methods of working are far in advance of those generally in vogue in this country, cleanliness throughout the preparation of the preserved article having received special attention.

Consideration is being given to the possibility of the economic growing of pineapples as a permanent crop and proposals for preliminary experiments have been put forward by this department for the consideration of the Governments concerned.

Attention continued to be devoted to the possibility of extending the market for Malayan pineapples by suitable displays at exhibitions and trade fairs, organised by the Malayan Information Agency acting in co-operation with the Empire Marketing Board.

There is evidence to show that these efforts are meeting with the success which was hoped for.

(*b*) Bananas.—Both as a mixed crop and also as a catch crop with rubber, bananas are fairly extensively cultivated in Johore and besides supplying local consumption, a fairly considerable export to the Singapore market is maintained. Bananas are grown generally only in scattered small areas throughout the country, in some cases in hardly sufficient quantity to supply the demands of the local market. The notable exception is in the Jelebu district of Negri Sembilan, where there is an area of 3,600 acres in one block under this crop, the fruit being sent to Kuala Lumpur and other large centres. The plants do well for the first few years after planting on virgin soil, after which production falls off rapidly and the crop becomes attacked by Panama Disease and suffers from lack of nutrition. The problem of how to keep the soil fertility up to the standard required by this crop is a difficult one in this country where farmyard manure, or any substitute therefor, is scarce.

(*c*) Other Fruits.—The local fruits are reported to have been plentiful in Malacca during the year but only fair elsewhere.

VEGETABLES.

The vegetables of the country are grown almost exclusively by Chinese, often by settlers on land under temporary licence. The results obtained by investigating the position with regard to the vegetable supply in Selangor led to the appointment of a Chinese Sub-Inspector of Agriculture to undertake similar work in Perak. The results of his investigations as regards Kinta are now to hand and it is estimated that there is an aggregate of 750 acres under vegetables in that district, made up of a number of small gardens, each garden seldom reaching an area of four acres. The investigations have also revealed the fact that the economic side of the question is not such as is desirable. Practically the whole of the vegetable trade is in the hands of two agencies, one operating in Kinta and the other outside Kinta. These agencies buy vegetables from the growers, collecting them in lorries, and resell them to the market vendors at a high profit. The agencies also import seed from China and supply to the growers at a high cost.

LIVE STOCK.

The dependence of the country on imports of tinned milk, meat and poultry and also for working cattle and buffaloes renders the live-stock position most unsatisfactory. The needs of the situation are for a definite and carefully thought out policy for measures to increase live-stock in the Peninsula and to render it less dependent on imported supplies.

To exemplify the present position, it may be stated that net importation of live cattle for slaughter totalled 50,855 in 1929, of tinned milk 1,930,117 cases valued at $14,110,024 during the same period; of butter 15,659 cwt., valued at $1,172,144; of poultry (alive) 408,957 valued at $325,276; and eggs, fresh and salted, to the value of $1,448,777.

During the year a proposal was approved for the Principal Veterinary Officer, whose appointment has been sanctioned by Government, to consult with the Director of Agriculture with a view to the formulation of a definite stock policy, but up to the end of the year nothing had been done owing to the non-arrival of this officer in the country.

The developments which are obviously needed comprise the improvement of dairy cattle and milk supply, the improvement of cattle for meat supply, draught and stud purposes, the improvement of small live-stock particularly goats, pigs, etc., and the improvement of poultry.

So far the only steps taken officially consist in the maintaining of a small herd of five dairy cows by the Public Works Department at Fraser's Hill. There is a small stock farm at Serdang, while at Ipoh and Kuala Lumpur arrangements exist for centralising and controlling the production of milk by certain small groups of Indian cow-keepers. It has been proposed that the cattle at Fraser's Hill should be taken over by the Department of Agriculture and the number increased to meet the demand for milk supply for the residents of this hill station, while a small sum has been annually provided in the estimates for extending the dairy work at Serdang. It seems obvious that the next step is the provision of dairies for the large and more populous centres such as Singapore, Kuala Lumpur, Penang and Ipoh for the provision of clean fresh milk for hospitals and for limited sale to the public. Experience in other tropical countries has shown clearly that the production of clean milk presents very little real difficulty and that dairies if properly run will be self-supporting.

It is hoped that within the next year it may be possible to arrive at a definitely established line of policy in connection with this important question.

Part II.

THE WORK OF THE DEPARTMENT OF AGRICULTURE.

Staff.—The establishment of the Department of Agriculture including the Director of Agriculture comprises 46 European officers. Of these 30 were on the research staff, one was Agricultural Instructor and one was seconded for service in Johore. Five of these appointments were not filled while two officers were seconded, one to the Rubber Research Institute and the other to the Co-operative Societies Department. Details in relation to the staff are given in Appendix A.

At the commencement of th year the post of Director of Agriculture was substituted for that of Secretary for Agriculture and Dr. H. A. Tempany, formerly Director of Agriculture, Mauritius, was appointed to the post. Dr. Tempany arrived in Malaya and assumed duty as from 22nd February.

INTRODUCTION.

During the year much attention was devoted to the organisation of the Department of Agriculture and to the question of formulating a definite agricultural policy.

Owing to the frequent changes in the holder of the office of Secretary for Agriculture which were necessitated by the general exigencies of the service during the period of eight years in which the appointment was held by members of the Malayan Civil Serivce a certain amount of discontinuity of policy was inevitable. In consequence an attempt was made to survey the various lines of activities of the department and to put forward proposals for co-ordinating the work of the different divisions and laying down a definite line of policy for the future. These proposals included the reorganisation of the work of a number of divisions of the department and occupied a considerable amount of time during the year.

The Agricultural Advisory Committee at the close of the year was composed of the following members:

The Director of Agriculture (*Chairman*);
The Raja Muda of Perak;
L. P. Jorgensen, Esq.;
W. A. Stanton, Esq.;
M. J. Kennaway, Esq.;
J. Melville, Esq.;
G. S. Reis, Esq., B.Sc. (Agric.);
A. Sharples (*Secretary of the Committee*).

The Committee held four meetings during the year including a special meeting in December for the purpose of discussing measures in relation to tea. On the occasion of this meeting the Committee paid a special visit to the Experimental Plantation at Serdang.

Proposals were discussed for extending the personnel of the Committee. These proposals were approved during the year and in consequence as from the beginning of January the Committee was strengthened by the addition of two unofficial members, two official members, namely, the Director of Co-operation and a representative of the Education Department together with the Director of the Rubber Research Institute.

The Technical Committee of the department was maintained during the year, the Director of Agriculture acting as Chairman, while in addition a departmental commitee was constituted for the purpose of co-ordinating research work in progress on coconuts and oil palms. During the early stages Mr. A. Sharples, Personal Assistant to the Director of Agriculture, acted as Chairman of the latter Committee, later in the year the Chairmanship was assumed by the Director of Agriculture.

A departmental Committee was also constituted for the purpose of dealing with all publications of the department, the Committee consisting of the Director of Agriculture, the Chief Field Officer, the Personal Assistant to the Director of Agriculture together with the Director of the Rubber Research Institute, the Agricultural Economist acting as Secretary. It was approved by Government that the latter officer should assume charge of all departmental publications during the year as a part of his regular duties.

In relation to publications an important change was approved during the year whereby the *Malayan Agricultural Journal*, which had been for some years past practically the only vehicle for departmental publications, became modified in form as from 1st January, 1930, being enlarged and assuming a more popular form. The material published therein now comprises agricultural articles divested so far as possible

of scientific technicalities, abstracts of articles from other papers, editorial notes and commentaries and items of local interest. The results of scientific work will be published in the form of special bulletins, and if an opportunity offers, as contributions to the journals of scientific societies in the United Kingdom.

Early in the year the work of the Field Division was reviewed by the Director, who formed the opinion that, whilst inspection duties, or crop pest and disease control, were being administered and performed satisfactorily, the instructional activities of the division, having as their object improvement in agricultural methods and practice, had not received the attention they deserved.

It was decided that in order to effect improvement certain changes would be necessary, namely, more direct contact between the Director and Agricultural Field Officers, the establishment of Demonstration Stations and Padi Test Plots at approved places, improved liaison between the department and with the Rubber Research Institute and the adoption of a broader agricultural outlook by all grades of the Field Division staff.

An Agricultural Field Officers' Conference was held in October at which the matter was discussed, and definite plans formulated with the end in view that the improvements considered so desirable would gradually be effected.

At the end of the year some progress can be reported. Official correspondence has been modified to allow of the Director being brought into closer touch with Field Officers, standardised monthly reports from Field Officers have been instituted, the Field Division has accepted greater and more definite responsibility for school gardens, definite schemes of co-operation with the Education and Co-operative Departments and with the Rubber Research Institute are in being, a scheme of liaison between the Field and Economic Botany Divisions regarding the improvement of padi has been formulated, improvements in the methods of collecting crop statistics have been effected and progress has been made in the matter of selecting sites for demonstration stations and padi test plots.

Particular attention has also been devoted to the establishing of liaison between the working of the Agricultural Department and that of other institutions whose activities are allied, notably the Co-operative Department, the Rubber Research Institute and the newly formed Department of Statistics, Straits Settlements and Federated Malay States.

Numerous opportunities were taken for establishing contact with the Co-operative Department and whenever possible better liaison was aimed at especially in so far as work in the country districts is concerned.

In relation to the Rubber Research Institute the Secretary for Agriculture was formerly ex officio Chairman of the Board of that body. On the appointment of the Director of Agriculture this policy was changed and the Board was given power to elect its own President. For the remainder of the year 1929, however, the Director of Agriculture was elected President of the Board.

Steps have been taken during the year to place on a better footing the relationship that exists between the Department of Agriculture and the Rubber Research Institute. It is now definitely accepted and approved both by Government and by the Board of the Rubber Research Institute that (*a*) the Department of Agriculture constitutes the official organisation for the control of rubber pests and diseases, measures applied being based on the recommendation of the Research Staff of the Rubber Research Institute, (*b*) the extension services of the Department of Agriculture constitutes the first line for the dissemination of information concerning rubber cultivation among small cultivators in the Straits Settlements and Federated Malay States, (*c*) the Field Officers of the Department of Agriculture, as and when opportunity offers, should form the means of bringing to the notice of the Rubber Research Institute matters of importance in relation to the conditions of the rubber industry in the various districts. In the work of disseminating information it was further agreed that the Co-operative Department should participate as far as their membership is concerned, in the different districts.

In relation to extension services a scheme was formulated late in the year for propaganda work by means of a caravan including a cinema outfit to be operated by the three institutions acting in conjunction and under the control of a committee composed of the heads of the three departments with the Director of Co-operation as Chairman. The organisation comprises arrangements for the taking and making of educational cinema films, for their display, for the showing of exhibits and for the delivery of lectures. There seems to be every reason to expect that the close association of the three institutions in this way will be productive of satisfactory results.

Discussions have also taken place with the Statistical Department in relation to the organisation of statistics. The question of the collection of padi statistics has been discussed at considerable length between the Director of Agriculture and the Registrar-General of Statistics and arrangements made for the regular collection of these

through the instrumentality of the Field Staff. Further the work of the Deputy Registrar of Statistics which was conducted as a branch of the Statistical Department has now been transferred to the Agricultural Department and this officer placed in charge of all agricultural statistical work. The arrangement has been approved for one year in the first instance.

Proposals were also under discussion for the extension of agricultural statistical services to the Unfederated Malay States during the year. At the end of the year this proposal was still under consideration.

Important developments have taken place on the educational side. During the early part of the year it became apparent that work in relation to school gardens was very uneven throughout the peninsula, being excellent in some States and Settlements, and decidedly below standard in others.

In consultation with the Director of Education a scheme was formulated during the year whereby the Department of Agriculture assumed fuller responsibility for school garden supervision and a definite scheme of operation was agreed upon. This scheme comprises the payment of regular visits to all school gardens by officers of the Field Division of the Agricultural Department, the forwarding to the Inspector of Schools concerned regular reports on the school gardens in his area once each month, and the giving of advice in relation to the selection of sites and the establishment of school gardens: the Education Department being responsible for financial provision for the upkeep of these gardens. At present there are 457 school gardens in the Straits Settlements and Federated Malay States.

Close contact has been maintained with the Principal of the Sultan Idris Training College, Tanjong Malim. In the curriculum of this institution special stress is laid on agriculture and nature study, and as it provides for the training of teachers for elementary schools throughout the Straits Settlements and Federated Malay States it exercises an increasing important influence on the outlook of the inhabitants. Conferences were in several cases held between the Director of Agriculture and the Principal of the Tanjong Malim Training College with a view to improving the standard of work.

The year is of importance inasmuch as it witnesses the commencement of the erection of the buildings of the new Agricultural School at Serdang, provision for the erection of this institution having been included in the estimates. By the end of December the erection of bungalows for the staff had been completed and the erection of the main school buildings was due to commence at the beginning of January, 1930.

The buildings when completed will comprise a teaching and administration block, a hostel, three residences for superior staff, four smaller residences for Asiatic teaching staff, coolie lines and outbuildings, together with provision for football field, students' gardens and recreation grounds. The experiment station at Serdang will serve a useful adjunct in the teaching and training of the students, and the institution itself should provide for a long felt want in Malaya. During the year details of the curriculum were fully worked out, submitted to the Advisory Committee for the School, adopted by it, and submitted to Government.

The Advisory Committee for the School consists of:

The Director of Agriculture (*Chairman*);
The Hon'ble the Datoh of Rembau;
The Hon'ble Mr. Tan Cheng Lock;
The Chief Inspector of English Schools, Straits Settlements and Federated Malay States;
L. Tivy, Esq.;
G. E. Mann (*Secretary*).

In the following paragraphs the principal lines of activity of the various divisions are briefly summarised. The complete reports of the different heads of divisions will be published as a separate bulletin of the department.

SUMMARIES OF REPORTS OF HEADS OF DIVISIONS.

FIELD DIVISION.

The inspection work was carried on along the customary lines. Mouldy Rot continued to be the most important disease of rubber during the past season. The infected area, however, shows only a slight increase during the year. Other diseases of rubber were not so much in evidence, although some attention was devoted during the latter part of the year to the reported prevalence of Oidium Leaf Disease.

During the year 17,162 notices were served on cultivators for the presence of disease on cultivations, 1,049 prosecutions were entered against cultivators for non-compliance with the terms of the notices served and 943 convictions secured.

Test plots and demonstration stations were maintained at the following points:

Kuala Kangsar Demonstration Station.—This consists of an area largely established with fruit trees.

Kamunting Green Dressing Station.—Laid down with the object of ascertaining whether a good padi crop could be obtained from dredged and slimed mining lands after the soil had been treated with green dressing crops.

Tallang Coconut Area.—Comprising a block of four acres planted with coconuts, the seed of which was obtained from high-yielding trees selected by the Economic Botanist.

Seremban Demonstration Station.—A small plot planted with seedlings of various citrus fruits, coffee and nutmeg.

Kuala Lipis Demonstration Station.—Comprising three acres originally opened as a fruit station. This station was considerably improved during the year and varieties of fruit crops planted for trials.

Pekan Experiment Station.—Comprising an area of fruit trees and food crops.

Padi test plots were maintained as follows at Tallang, Dong, Temerloh, Kuang, Kajang Paya and Pekan.

The Pulau Gadong Station at which the work of the Krian Experiment Station is duplicated was maintained during the year. Results had hitherto been disappointing owing to indifferent irrigation, flooding, lack of supervision and also rat damage. Improvements were effected during the year by repairing the dam, strengthening the river banks, and erecting quarters to enable subordinate officers to reside at the station. Throughout the year unremitting attention was given to rat control. The result is that at the end of the year there were prospects of obtaining reliable results from selection and manurial trials.

School Gardens.—The division assumed fuller responsibilities for school gardens during the year and now regularly inspects school gardens throughout the Peninsula. Considerable improvement has been visible as a result of this arrangement.

Agricultural shows were held during the year as follows: Perak North Show, Taiping, 31st August and 1st September; Upper Perak Show, Lenggong, 21st and 22nd June; Kuala Langat Show, 21st September; Jelebu Show, 27th March; Bentong Show, 28th September; Pekan-Kuantan Show, 18th July; Malacca Show, 20th and 21st July.

In the organising of all these shows, the Agricultural Field Officers took the leading part working in most cases in co-operation with the Malayan Agri-Horticultural Association.

The division was in charge of imports and exports of planting material under "The Plant Importation Rules, 1925". The following is a summary of the importations made during the year:

Budwood.	Rubber selected seeds.	Budded stumps.	Oil Palm seeds.	Coffee.		Tea seeds.
				Plants.	Seeds.	
135,175 metres	911,212	140,064	1,195,356	274	325 lbs.	3,200 lbs.

During the same period 115 inspection certificates were issued for planting materials.

Rat Campaign.—The organisation for rat control in the padi areas of Krian and Province Wellesley was maintained.

In Province Wellesley the total number of rat tails for which rewards were paid during 1929 amounted to 579,972. The total expenditure was $12,993.02, giving a cost per tail of 2.24 cents. The corresponding figures for 1928 were 509,151 tails, a total expenditure of $8,950.70 and an average cost per tail of 1.76 cents.

Most of the tails for which rewards have been claimed have been collected by the school children and by Tamil coolies. Trapping and poisoning have been the methods used. Rat drives have not proved popular and the results obtained hardly justify the time spent in organising them.

Damage by rats to the 1929-1930 crop was, up to the end of the year, practically negligible.

In the Krian district of Perak the number of tails for which rewards were paid in 1929 amounted to 623,712. The total expenditure was $15,114.42, giving an average cost of 2.42 cents per tail. The corresponding figures for 1928 were tails collected 914,644, total expenditure $17,995; average cost per tail 1.97 cents.

The number of tails collected in Krian since the inauguration of the campaign in 1924 have been as follows:

1924-25.	1926.	1927.	1928.	1929.
661,794	673,102	842,791	914,644	623,712

The experience gained in Krian during the last five years have shown that rat damage in padi fields can be reduced to negligible proportions by systematic trapping and poisoning, provided that this work is carried out sufficiently vigorously and continuously throughout the year over the whole area of padi land to be protected.

On the strength of the results obtained in Krian and Province Wellesley, a similar campaign making use of the same methods was started in Malacca during the month of October. In the course of preliminary work, 5,000 traps were distributed. The total number of tails for which rewards were claimed in November and December was 3,042.

A considerable quantity of seeds and plants were distributed through the agency of the division during the year consisting particularly of selected padi seed, planting materials of various vegetables and cereals to market gardeners and small cultivators and also of planting material and fruit trees to small cultivators as well as a considerable amount of planting material of various descriptions to school gardens. During the year the division undertook the summarising of all alienations of lands which took place in the Straits Settlements and Federated Malay States each month. The completed returns have been submitted to the Director of Agriculture.

MYCOLOGICAL DIVISION.

The principal work carried out by the division during the year comprised: (*a*) work on palm diseases, (*b*) work on *Phytophthora* sp., (*c*) work on *Pythium* sp., (*d*) work on Panama disease of bananas and (*e*) work on soil flora.

In relation to (*a*) it has been shown that lightning strike is a factor of importance in causing diseases of coconut palms. The work covered a period of two years and it is now held that lightning discharge is responsible for considerable damage in coconut areas in Malaya. Associated with it, as an after-effect, is a fungus *Marasmius palmivorus* Sharples, the primary cause of the attack being lightning strike with disease symptoms subsequently following, sometimes as long as two years afterwards. Control measures have been recommended which enable planters to save numerous palms which would otherwise die. It is now rare for palms other than those most seriously affected to succumb.

A stem rot of oil palms has been recorded and typical fructifications of *Fomes Lamaoensis* have been found to be associated with the disease. Experiments are being carried out for the control of the disease. At present the most effective method is to trim back the leaf bases of the stems of the palms and to coat the cut surface with a suitable protective covering.

A study of the local species of *Phytophthora* was completed and the results published early in the year.

Work on Panama disease of bananas has been continued and a detailed report will shortly be published.

Work on soil flora has included studies of *Azotobacter and Clostridium* on Malayan soils. Investigations of the root nodule organism *Bacterium radicicola* and the bacterial content of fertile and infertile soils are being made. A commencement was also being made of the study of *Protozoa.*

An investigation has been commenced on diseases of tea which may be expected to become evident if tea cultivation extends in Malaya as anticipated. Disease conditions have also been investigated in relation to gutta percha, *Albizzia Moluccana*, *Tephrosia candida* and sisal, while a large number of diseased specimens, sent in for examination by planters, were dealt with during the year.

CHEMICAL DIVISION.

Work carried out by the division during the year comprised: (*a*) investigations in relation to coconuts, (*b*) investigations in relation to oil palm, (*c*) investigations in relation to tapioca, (*d*) investigations in relation to *jelutong*, (*e*) investigations in relation to rubber seed, (*f*) investigations in relation to miscellaneous oil seeds, (*g*) investigations in relation to miscellaneous crops from the Government Experimental Plantation, Serdang, (*h*) investigations in relation to rice.

Coconut investigations comprised chiefly comparative investigation of Malayan copra with copra from Ceylon and Malabar with a view to ascertaining whether the alleged inferiority of Straits copra was really borne out in fact. Approximately 300 samples of copra were examined during the year.

Investigations in relation to oil palms have comprised routine analyses for estate factories, of which 118 were undertaken. An investigation of the drying of palm nuts was carried out. The degree of drying of the nuts required to enable them to crack easily and the kernels to separate was determined.

Investigations of the impoverishment of the soil as the result of tapioca cultivation were carried out in conjunction with the Agriculturist. Considerable progress was made with the third crop on the Serdang Experimental Plantation.

Investigation of tapioca factory procedure was continued, while the changes in starch content occurring in stems and tubers according to age was also examined.

An attempt was made to correlate differences in yield of tapioca tubers with variations in the manganese content of representative samples of plant material.

In relation to *jelutong* it was found that no increase in resin content occurs after several months' storage of creped refined *jelutong*. The addition of sodium phosphate to *jelutong* latex containing iron salts was found to give very satisfactory results. Routine determination of moisture in trade shipments were continued and during the year 14 shipments were analysed for moisture content.

Samples of rubber seed oil were prepared and despatched to the Malay States Information Agency. Other oil seeds examined were *Piqui-A* fruit, *Tonka* bean, *kepayang*, *rambutan* and *pulasan*.

Investigations in relation to miscellaneous crops from the Government Experimental Plantation, Serdang, include analysis of tuba root, routine determinations of fibre content of sisal leaves, the systematic determination of gambier content of leaves of *Uncaria gambier*, the examination of plants of *Hydnocarpus anthelmintica* and the preparation of oil from candlenut, *Aleurites Triloba*.

Rice.—One hundred and sixty-eight samples of various types of rice stored under different conditions were analysed in connection with the investigations made by the Economic Botanist.

Thirty reports on patent applications were submitted to Government by the Agricultural Chemist. The Chemist of the Forest Department and the Engineer Chemist, appointed by the Trade and Customs Department to investigate the production of alcohol from rice, were accommodated in the laboratory of the Chemical Division.

Eighteen articles were published in the departmental publication by the Chemical Division during the year.

ENTOMOLOGICAL DIVISION.

The work of the Entomological Division comprised identification of insects, work on insect pests of coconuts, oil palms, rice, coffee, rubber, tea and minor crops.

Five hundred and twenty-five specimens were forwarded to the Imperial Bureau of Entomology for determination and 289 were returned.

In relation to work on coconuts, the principal line of investigation has been in connection with the nettle caterpillar, *Setora nitens*, which gave much trouble during the first half of the year in the Teluk Anson and Bagan Datoh areas. Control methods by means of hand picking and by parasites were worked out and applied with the help of the officers of the Field Division. As a result the incidence of the attacks has been considerably reduced.

Rice.—Investigation concerning the stem borers of rice were started during the year. Attacks of padi borer in the month of May caused attention to be directed and concentrated on this problem and since then much time has been devoted to working out the technique of the parasitic method of control. This method is now being tried out in the Krian area but it is as yet too early to give any definite opinion on the results. The technique in question consists in breeding the parasite *Trichogramma* sp., on eggs of *Sitotroga cerealella*, and liberating the parasites in the padi fields.

The discovery of a predator of larvae of *Sesamia inferens* was made during the year, namely, the ant, *Diacamma vagans*.

Coffee.—Extensive damage to coffee in Johore was recorded by the larvae *Cephonodes hylas*. *Cryphalus hampei*, the beetle berry-borer, was also responsible for some damage. Its distribution in Malaya is apparently confined to Selangor, Negri Sembilan and Malacca.

The only two insects reported this year attacking rubber were *Cyana ridleyi* and *Valanga nigricornis* which caused some damage to young budgrafts.

Other insect investigations include pests of nipah palm, citrus, gutta percha, derris, areca nut, gambier, banana, soursop, sugar cane, maize and cover crops.

Numerous insects were sent in by planters for report and a large number of visits paid to estates and elsewhere in connection with routine work and investigations.

Three papers were published by the division in the *Malayan Agricultural Journal* for the year.

DIVISION OF SOILS AND PLANT PHYSIOLOGY.

The work of the division comprised the continuation of the work of a soil survey, studies in relation to padi soils, studies in relation to coconut soils, manurial investigations, percolation experiments and methods of analysis.

Soil Survey.—The work on the soil survey carried out during the previous year was consolidated and a preliminary report issued in the *Malayan Agricultural Journal*. Subsequently it was considered advisable, before examination of areas outside the surveyed districts, to undertake an examination of alluvial coastal soils, owing to their importance for coconuts and padi.

Padi Soils.—The padi tanks installed at Serdang were tried out during the year to test the general working of the installation and discover what difficulties are likely to be encountered.

Coconut Soils.—Investigation on coconut soils were suspended during the absence on leave of Mr. Belgrave.

A further series of pot culture experiments were carried out with Ragi.

Percolation experiments were continued on the lines previously followed.

Investigations in relation to methods comprised work on a modified method for potash. The Robinson method for total carbon was also examined and a new method for the ignition of citric soil extracts was studied.

A noteworthy feature has been the large increase in the number of routine soils received and examined for other divisions and for the general public, 696 samples have been examined in this way during the year. A number of special soils were examined during the year. These include Cameron's Highlands, Kuantan Dolerites, Pahang Volcanics and reslimed soils.

Seven papers were published on soil work in the *Malayan Agricultural Journal* during the year.

DIVISION OF ECONOMIC BOTANY.

The work of the Economic Botany Division comprised (*a*) work on the breeding and selection of improved strains of padi, (*b*) work on the storage of rice, (*c*) work on the quality of rice, (*d*) work on the improvement by selection of coconut palms, (*e*) similar work on oil palms and (*f*) work on minor crops.

Rice.—Pedigree line breeding and multiplication of the best strains was continued along the usual lines at the Titi Serong Experiment Station and the quantity of seeds distributed to growers amounted to 6,991 gantangs. The wide range of characters of the different pedigree strains enabled selections of them to be grown under varying conditions of soil and water, and they have become popular in many parts of the Peninsula on account of their high yielding and other good qualities. In the southern part of the Peninsula, more particularly in Malacca, the Titi Serong strains so far tried have not yielded as well as elsewhere. It is for this reason that selection work with the best local varieties has been started at the Pulau Gadong Station. Besides pedigree line selection, manurial and cultivation work experiments were made in the crossing of the best strains in the endeavour to raise forms superior to those already grown.

The Titi Serong Station was also used as a training centre for Padi Inspectors from the different States.

In order to ascertain how long imported rice could be stored locally without serious deterioration, a special store was erected in 1927 at head-quarters. The physical and chemical characters of the best strains of rice were studied and analyses so far made by the Chemical Division indicate that the selected Radin strains have, as a rule, a higher nutritive value than the Seraups.

Coconuts.—Further records of the fruiting characters of 530 palms at Carey Island were taken in continuation of the work of the previous eight years. Studies of the chief dwarf races were continued. At the coconut selection station near Klang, where 50 acres are already planted in plots of 25 palms each, another area of 30 acres adjoining it was fenced and drained for the planting up with the progeny of the palms already established. Hybridisation experiments with certain of the dwarf and tall palms were commenced during the year.

Oil Palms.—Investigations were undertaken in connection with the selection of oil palm seeds for planting. Six hundred palms were numbered and from each one of these records are being made of the total weight of the bunches and certain important characters of the fruit with a view to facilitating selection work at a later stage.

Nipah Palms.—Work was commenced on the study of the flowering of the nipah palm. It was noticed during the year that many inflorescences failed to set fruit, with the result that they are useless for tapping purposes. The investigations involved the studying of the palm's flowering characters and the means by which pollination is effected.

Cotton.—Work on cotton was continued, as well as on soya-bean, groundnuts and maize.

A meteorological station was inaugurated at Klang and arrangements made for a similar station at Titi Serong.

A number of botanical identifications were made for the general public and for the Public Works Department during the year. The Acting Economist Botanist paid an official visit to the island of Labuan to report on agricultural conditions there during the month of July. Four papers were published by the division in the *Malayan Agricultural Journal*.

INSTRUCTION DIVISION.

There were 25 Malay Apprentices in training at the beginning of the year, of whom 14 were derived from the Federated Malay States, three from the Straits Settlements and eight from the Unfederated Malay States. Ten apprentices were recruited in April and began their training in May.

Eleven second-year students left the division in April on completion of the course, 10 being appointed Junior Agricultural Assistants and one being dismissed for failure to pass the examination. At the end of the year there were 23 apprentices in training: 16 were from the Federated Malay States, two from the Straits Settlements and five from the Unfederated Malay States.

Lectures were given throughout the year by the Agricultural Instructor and the Assistant Agricultural Instructor. Promotion examinations were held in April, 10 out of 11 students being successful.

Health and discipline were satisfactory throughout the year.

A short refresher course attended by 24 Malay Officers was organised and held during the month of April.

The Agricultural Instructor continued to act as Secretary to the Advisory Committee for the School of Agriculture, Malaya. The building plans approved by the Committee of 1928 proved unacceptable to Government. Revised plans were drawn up by the Public Works Department and were passed during the second quarter. The building programme for the year was confined to the erection of quarters, specially for the staff. A further area of 16 acres was added to the school site for the cultivation of coconuts and rubber. Proposals for the organisation of the work of the school were submitted to Government in September.

The Agricultural Instructor was responsible for the publication of vernacular bulletins during the absence of the Agricultural Economist on long leave. The Agricultural Instructor assisted the Director of Agriculture in the preparation of proposals for the reorganisation of the Asiatic staff of the department. The majority of the Malay apprentices continued their service in the Selangor Malayan Volunteer Infantry and attended the annual camp at Port Dickson in August.

DIVISION OF ECONOMICS.

The Agricultural Economist was on long leave from 9th March to 29th November. During this period, on the recommendation of the Director of Agriculture, he undertook an enquiry into conditions attending the marketing of copra in the United Kingdom. The results of this enquiry have been published in the *Malayan Agricultural Journal*. The outstanding feature of the present position is that in spite of the increase in supply of oil crops, the market has been able to absorb supplies of copra coming forward. The consensus of opinion appears to be that the consumption of edible oils is increasing so steadily that it will continue to absorb all future supplies.

It was approved during the year that the division should be responsible for analysing the Malayan returns in connection with the World Agricultural Census, 1930, forms used for the census being prepared by the division with instructions for their use.

Statistics relating to the area planted with oil palms in Malaya have been revised and brought up to date. The total area planted is now 31,709 acres. Further enquiries have been made during the year concerning conditions attending the production of pineapples, tapioca and coffee.

The division continued to be responsible for the vernacular publications of the department. The Malay Agricultural Journal, *Warta Perusah-an Tanah*, was published quarterly, 4,500 copies of the first number being printed which, owing to the increased demand, was then increased to 5,000 copies per issue. Articles in this volume included coconut cultivation, plant propagation, coffee, control of white ants, by-laws of Co-operative Rubber Factories, treatment of diseases in animals and fish pond culture.

Volume III of the *Chinese Journal* was published in three quarterly parts—one being a double number—of 5,000 copies each. The subjects treated in the double number were "The Preparation of Rubber" by Major B. J. Eaton, Acting Director of the Rubber Research Institute, rubber seed oil, gambier, tea and plant propagation.

A special reprint was published on the cultivation of oil palms.

Two articles were contributed by the Agricultural Economist to the *Malayan Agricultural Journal* during the year. The Agricultural Economist acted as Assistant to the Director of Agriculture in addition to the duties of his post until he proceeded on leave.

AGRICULTURAL DIVISION.

EXPERIMENTAL PLANTATION, KUALA LUMPUR.

Crops in the Field.—The average number of rubber trees tapped during the year was 4,233. Eighteen thousand two hundred and seventy pounds of No. 1 and 1,962 lbs. of lower grade rubber being harvested. The Brazil nut trees yielded a large crop of fruits. Cropping experiments were undertaken with the following—tapioca, maize, sorghum and gingelly. The new cover plants, *Dunbaria Heynei* and *Dolichos Falcatus* received attention but so far do not show much promise. A small pepper garden was planted. In view of the unsuitability of this area for experimental work, proposals were considered during the year for its abandonment: these have been submitted to Government by the Director of Agriculture.

THE EXPERIMENTAL PLANTATION, SERDANG.

Development.—An oil palm factory was erected during the year, the Federated Malay States Government Factory supervising the work. The plant consists of a 36/42 B.H.P. Ransome compound steam engine and semi-portable boiler, oil tanks, sterlising tanks, shafts and supports, oil pump and a centrifugal palm oil extractor made by Messrs. Manlove and Alliot. The machinery was housed in an Italit-roofed building.

A Walker's "Little Giant" tea roller, roll breaker, tea cutter, sieves and tats were purchased and installed temporarily in the sisal factory and implement shed. A small kiln for firing leaf was erected. Eighteen chains of additional road were constructed. Special attention was given to the question of soil erosion on unprotected areas. Sixteen chains of fencing was erected on the cattle farm area.

Distribution of Planting Material.—This included 166,300 oil palm seeds, seeds and cuttings of various food crops, fruit trees, coffee seed, fodder grasses, cover crop seed and cuttings of shade trees.

The more important introductions of planting material during the year comprised *Albizzia Fastigata* and *A. Stipulata*, *Hydnocarpus Woodii*, groundnut varieties from Madras, seed and seedlings of *jelutong* (Dyera) sp. varieties of citrus, tea seed and tapioca varieties from Mauritius.

Resident labour force comprised 480. The health of the labourers was good. All buildings were maintained in good order. Two sets of coolie lines, one shed for working bulls, one kitchen for bullock drivers and food cooking room for stock, one temporary pig shed, oil palm factory, one building consisting of six loose boxes for stud bulls and one boiler house for dairy were erected during the year. In addition a laboratory with fittings and furniture was also erected departmentally.

EXPERIMENTAL WORK.

Oil Palms.—Over 100 acres of oil palms were in bearing and with the completion of the factory, the plantation is well equipped to carry out research work on oil palms. An area of five acres was set out for manurial experiments. Similar experiments are being conducted on two estates in Selangor. Other experiments conducted dealt with planting of intercrops and cover crops, removal of leaves, artificial pollination and germination of oil palm seeds.

Tea.—A further 20 acres was planted during the year with seeds received from Ceylon and Assam. Other principal crops under experiment included Chinese wood oil, tuba root, sisal, gambier and sugar palm.

Stock Farm.—The farm was increased by the addition of two pedigree Holstein bulls obtained from Hongkong and two large black boars, two large black sows, two middle white Yorkshire boars, and two middle white Yorkshire sows. One large black boar died from heat apoplexy upon arrival. At the close of the year the stock was as follows:

Cattle—

Montgomery Herd—five stud bulls, nine mature cows, three heifers, five bull calves, one heifer calf.

Ayreshires—Two heifers.

Holsteins—Two stud bulls.

Jersey—One stud bull (on loan to the cattle farm, Central Mental Hospital, Tanjong Rambutan).

Pigs—

Two middle Yorkshire boars, one large black boar, six pure-bred large black young pigs, seven pure bred middle Yorkshire pigs, 11 cross-bred young pigs.

The milk yields from the Montgomery cows were disappointing, not exceeding 405 gallons of milk during a lactation period of nearly 12 months. The present policy in relation to stock was considered during the year and a preliminary working policy laid down.

EXPERIMENTAL PLANTATION, CAMERON'S HIGHLANDS.

The plantation is situated at Tanah Rata at an elevation of about 4,750 feet.

Development.—A further 14 acres of hilly land was cleared and prepared for planting tea. The new office and store was completed and occupied in February. Plant introduction comprised *Cinchona Ledgeriana, C. Succirubra, Carica Candamarcensis, Cupressus Knightiana, C. Macrocarpa* and a large collection of ornamental plants from Ceylon.

Nurseries.—Specially constructed germinating beds for cinchona plants were prepared and proved satisfactory. A large number of healthy cinchona plants were established.

Planting Operations.—The area under Arabian coffee was increased to six acres, while the tea area was extended to 30 acres. Cinchona seedlings were supplied and cardamon plants were removed from the nursery and planted out.

Crops in the Field.—Crop records from the original area of Assam and Manipuri tea have been taken over a period of two years. Yields were, first year ending July, 1928, 470 lbs., second year ending July, 1929, 525 lbs. Immature areas of tea are progressing favourably.

The cinchona area showed much improvement. Small samples of bark submitted to the Government Quinologist, India, for analysis were well reported on.

Labour.—The Indian labour employed has been satisfactory, and the health of the labourers was good.

Eight articles were published by the Agricultural Division in the *Malayan Agricultural Journal* during the year. Mr. Milsum visited Ceylon in December, 1928, and also Java in May, 1929, as a delegate to the Pacific Science Congress.

Numerous visits were paid by the staff to estates to advise on various agricultural problems and many enquiries were received and answered. An exhibit of oil palm, tapioca and sisal hemp was prepared and staged at the Agri-Horticultural Show held at Taiping in August.

GENERAL.

In the month of April four delegates from the Department of Agriculture attended the Pacific Science Congress in Java: these were the Director, Dr. Tempany, the Chief Field Officer, Mr. South, the Economic Botanist, Dr. Jack, and the Assistant Agriculturist, Mr. Milsum.

Papers were presented to the Congress by Dr. Jack on selection work in relation to coconuts and rice. A full report of the Conference was submitted to Government.

The year has been one of considerable activity, mainly owing to the inception of a number of new lines of work and the recasting and reorganising of numerous existing lines of activity.

It affords me very great pleasure to record the fact that the entire staff of the department has responded fully to the additional calls made on it, and has collaborated heartily in the numerous new projects in which it has been called upon to bear a part.

H. A. TEMPANY,

Director of Agriculture, S.S. & F.M.S.

APPENDIX A.

DEPARTMENT OF AGRICULTURE, STRAITS SETTLEMENTS AND FEDERATED MALAY STATES.

ORGANISATION.

Agriculture ...	Director of Agriculture ...	H. A. Tempany, D.SC., F.I.C., F.C.S.
	Librarian and Translator ...	L. A. J. Rijk
	Agriculturist	B. Bunting, N.D.A., F.L.S.
	Assistant Agriculturists ...	J. N. Milsum, F.L.S.
		T. D. Marsh, N.D.A.
		E. A. Curtler, M.A., Cam. Dip. Agr.
		J. Lambourne
		J. L. Greig, B.SC., B.SC. (Agric.)
	Horticultural Assistants ...	H. Ritchings
		F. S. Banfield, F.L.S.
	Agriculturist (Rubber) ...	F. G. Spring, N.D.A., U.D.A., F.L.S. (Seconded to the Co-operative Societies Dept.)
Chemistry ...	Agricultural Chemist ...	B. J. Eaton, O.B.E., F.I.C., F.C.S., F.I.R.I. (Seconded to the Rubber Research Institute.)
	Acting Agricultural Chemist	C. D. V. Georgi, O.B.E., B.SC., F.I.C.
	Assistant Agricultural Chemists	V. R. Greenstreet, A.I.C.
		R. G. H. Wilshaw, B.A., B.SC., A.I.C.T.A.
	Assistant Chemist for Copra Investigations	F. C. Cooke, A.R.C.S., B.SC., A.M.I.CHEM.E.
	Assistant Analyst	Gunn Lay Teik, B.A.
Economics ...	Agricultural Economist ...	D. H. Grist, Cam. Dip. Agr.
Economic Botany	Economic Botanist	H. W. Jack, D.SC., B.A.
	Assistant Economic Botanists	W. N. Sands, F.L.S.
		R. B. Jagoe, B.SC.
Entomology ...	Entomologist	G. H. Corbett, B.SC.
	Assistant Entomologists ...	N. C. E. Miller
		H. T. Pagden, B.A.
Mycology	Mycologist	A. Sharples, A.R.C.S., D.I.C.
	Assistant Mycologists ...	A. Thompson, B.SC.
		R. A. Altson, B.SC., A.R.C.S.
		F. S. Ward, B.S.A. (McGill)
Field	Chief Field Officer	F. W. South, M.A.
	Agricultural Field Officers—	
	Perak North	F. Birkinshaw
	Selangor	A. E. Coleman-Doscas, Dip. Agr., W.A.
	(On leave)	J. Fairweather, N.D.A., U.D.A.
	Province Wellesley ...	F. R. Mason, Dip. Agr. (H.A.A.C.)
	Pahang East	J. M. Howlett, M.C., B.A., Cam. Dip. Agr.
	Singapore	J. W. Jolly, Dip. Agr. (Hawkesbury).
	Malacca	C. L. Newman, B.SC. (Agr.)
	Perak South	J. A. Craig, N.D.A., C.D.A., A.I.C.T.A.
	Pahang West	R. G. Heath, B.SC. (Agr.) A.I.C.T.A.
	Negri Sembilan	W. H. Barnes
	Principal Agricultural Officer, Johore	F. de la Mare Norris, B.SC.
Instruction ...	Agriculture Instructor (M.O.)	G. E. Mann, M.C., M.A.
Soils and Plant Physiology ...	Plant Physiologist	W. N. C. Belgrave, B.A., Cam. Dip. Agr.
	Assistant Chemist	J. H. Dennett, B.SC.
Statistics ...	Statistician	J. Gordon-Carrie, B.SC.

Federated Malay States Government Press.